EFFECT OF PROTECTED INDIAN SARDINE (*Sardinella longiceps*) OIL, PALM OIL, AND PALM KERNEL CAKE INTAKE ON DIGESTIBILITY OF DRY MATTER, ORGANIC MATTER, AND CRUDE PROTEIN BY RUMEN FLUID OF FISTULAE ONGOLE BREED CATTLE

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Abstract

Livestock business, ruminant in particular, has been growing rapidly with the increased demand of high quality food ingredient, such as meat and dairy products. However, digestion process in ruminants is relatively more complicated compare to other animals. Carbohydrate is the main energy source and fat as the alternate, both from vegetable and animal's fat. This study aimed to determine the effect of protected Indian sardine fish oil, palm oil, and palm kernel cake consumption on digestibility of dry matter, organic matter, and crude protein by rumen fluid of fistulae Ongole breed cattle. Latin square experiment design was applied on 3 treatments. Fermented rice straw (FRS), basal concentrate (BC), and protected materials of Indian sardine oil (ISO), palm oil (PO), and palm kernel cake (PKC) were used as feed ingredient. Treatments were: P1 = FRS 40% + BC 60 % (BC 95% + PO 5%) ; P2 = FRS 40% + BC 60% (BC 95 % + ISO 5%) ; P3 = FRS 40% + BC 60 % (BC 90% + PKC 10%). Analyzed parameters were intake and digestibility of dry matter, organic matter, and crude protein, and also digestible nutrient of organic matter (DN OM) and crude protein (DN CP). The results showed that average dry matter intake of P1, P2, P3 were 6108.77; 5965.87; 5686.78 (g/head/day), organic matter intake were 5658.19; 5569.29; 5603.11 (g/head/day), protein intake were 690.58; 829.84; 818.15 (g/head/day), dry matter digestibility were 54.55; 54.00; 54.23 (%), organic matter digestibility were 66.09; 66.59; 64.00 (%), crude protein digestibility were 81.77; 80.48; 79.73 (%), DN OM were 61.33; 62.06; 63.06 (%), and DN CP were 10.69; 10.34; 10.82 (%), respectively. Analysis of variance showed no significant difference between intake and digestibility of dry matter, organic matter, crude protein, DN OM, DN CP ($P > 0.05$) among treatments. It was concluded that consumption of 5% Indian sardine oil, 5% palm oil, and 10% palm kernel cake protected materials did not affect of dry matter, organic matter, and crude protein digestibility in fistulae Onggole Crossbreed rumen.

Keywords: Ongole grade cattle, Indian sardine oil, palm oil, and palm kernel cake, digestibility

1. Introducctions

Ruminant using carbohydrate main energy source and fat as the alternate. Fat increase in feed was used to increase energy level and also to modify fatty acid composition of ruminants' body (Soebarinoto, 1991). Saturated fatty acids were commonly found in ruminants body, while unsaturated ones were found in fish.

Fat source for ruminant feed could be provided both from animal and plant. Among animal fat source, Indian sardine known in Indonesia as *Lemuru* has been known for its high level of polyunsaturated fatty acids, while plant-origin fat can be obtained from palm oil or palm kernel cake. The last two were palm oil processing byproduct, which utilization was still limited, particularly as raw material for ruminants feed (Noel, 2003). However, feed supplementation using Indian sardine oil, palm oil, and palm kernel cake constrained by hydrolisis and hydrogenation. Furthermore, feed supplementation using high content material potentially inhibit rumen microbial activity. Therefore, material fat content need to be protected from hydrolisis and hydrogenation in rumen but remain digestible inside intestinal tract. Beside, fat protection was also used to avoid side effect of fat utilization, such as decreased fiber digestibility (Sumantri, 2005).

2. Material and method

2.1. Material

Three female fistulae ongole cows at average weight of 289.33 ± 28.34 kg weight was used in experiment. Feed was made from Fermented Rice Straw (FRS) and Basal Concentrate (BC), Indian sardine oil, palm oil, and palm kernel cake, where

dry matter was given as much as 3% of body weight. Drinking water was given *ad libitum*.

2.2. Method

Main materials for feed were Fermented Rice Straw (FRS) and Basal Concentrate (BC), while treatments were given through addition of protected material of Indian fish oil, palm oil, and palm kernel cake. Oil samples were protected using saponification method by Cabatit (1979) *cit* Widiyanto (2008) where KOH and $CaCl_2$. KOH was transformed into Ca using $CaCl_2$. Approximately 300 gram of either Indian sardine oil or palm oil was put into beaker glass and heated to 90ºC. During heating, a mixture made from 33.6 gram KOH and 65.601 gram $CaCl_2$ dissolve in distilled water was put into fish oil, while those made from 32.928 gram KOH and 65.268 gram $CaCl_2$ was put into palm oil, stirred for 10 minutes until kalium soap suspension formed. To transform kalium soap into Ca salt, $CaCl_2$ was stoichiometric calculated, weighed and dissolved into distilled water. $CaCl_2$ solution then added into soap suspension while heated in water bath at 90ºC and stirred until Ca sedimentation. Palm kernel cake protection was carried out using a method by Widyobroto (1999). Formaldehid 37% was sprayed to palm kernel cake 2 % dry weight evenly, let stand overnight then air-dried. Latin square experiment design was applied on 3 treatments at 3 experimental periods

Treatments applied were feed formula made as follow:

P1 = FRS 40% + BC 60 % (BC 95% + Palm oil 5%)

P2 = FRS 40% + BC 60% (BC 95 % + Indian sardine oil 5%)

P3 = FRS 40% + BC 60 % (BC 90% + Palm kernel cake 10%)

.3. Results and Discussions

Intake of Dry Matter, Organic Matter, and Crude Protein

Analysis of variance showed that all treatments caused no significant different (P>0.05) toward dry matter, organic matter, and crude protein intake. Tillman et al. (1991) mentioned that nutrient significantly affect feed consumption was energy content. Dry matter intake of sample P1 (protected palm oil) was higher than P2 (protected Indian sardine oil) despite similar oil presence, due to gross energy difference between those two treatments (Table 1).

Gross energy of P1 and P2 was 90 kkal and 182 kkal, respectively. Higher gross energy might decrease dry matter intake. Parakkasi (1999) noted that feed intake was basically intended to meet energy requirements of cattle, so the animals stop eating when energy needs are met. For immediate meeting of energy requirement, high quality of feed was given to cattle with high energy level. Protected palm kernel cake utilization in P3 treatment resulted different intake amount due to high protein content. Thus, energy and protein requirement was met with lower amount of feed compare to P1 and P2. In this research, Total Digestible Nutrient was in range of 52 – 55 % and Gross Energy (GE) was among 90 – 182 Kkal, which statistically not significant different. It was indicated that TDN and GE did not affect protein content.

Tabel 1. Average intake of dry matter, organic matter, and crude protein of fistulae Ongole breed cows (gram/head/day

Average intake	Treatment		
	P1	P2	P3
Dry matter (DM)	6108.77	5965.87	5686.78
Organic matter (OM)	5658.19	5569.29	5603.11
Crude Protein (CP)	690.58	829.84	818.15

Digestibility of Dry Matter, Organic Matter, and Crude Protein

Analysis of variance result showed that all treatment caused no significant different (P>0.05) toward dry matter, organic matter, and crude protein digestibility. Utilization of protected palm oil, Indian sardine oil, and palm kernel cake for feed did not affect dry matter digestibility. In this research, average digestibility of dry matter from feed made using protected palm oil was 54.55% with TDN of 52.79%; while P2 (protected Indian sardine oil) with TDN 52.79% had dry matter digestibility average of 54.00%. At similar energy level, different dry matter digestibility was resulted due to lower palatability of P2 using protected Indian sardine oil compare to P1. Protected palm kernel cake in P3 had TDN of 55.39% and dry matter digestibility of 54.23%.

Wodzicka et al. (1993) mentioned that digestibility level was caused by intake amount, dry matter in particular. It also noted by Tillman et al. (1991) that feed consumed was also affecting digestibility level. In this study, all high quality feed material were used for 3 treatments, with adequate feed amount as well. Anggorodi (1990)

explained that high level of dry matter digestibility indicating good feed quality.

Tabel 2. Average digestibility of dry matter, organic matter, and crude protein of fistulae Ongole breed cows (gram/head/day)

Average digestibility	Treatment		
	P1	P2	P3
Dry matter (DM)	54.55	54.00	54.23
Organic matter (OM)	66.09	66.59	64.00
Crude Protein (CP)	81.77	80.48	79.73

Digestible Nutrient of Organic Matter (DN OM) and Crude Protein (DN CP)

Analysis of variance result showed no significant different among observed parameters (P>0.05). Kamal (1994) mentioned that digestible nutrients (DN) of feed was calculated using nutrients content of feed and remained nutrients in stool. In this study, DN OM values among treatments were different, particularly P3 that prepared using protected palm kernel cake. This was due to the higher digestibility of palm kernel cake than P1 and P2 which prepared using feed material with high content of fatty acids, implicate to the lower palatability.

Tabel 3. Digestible nutrient of organic matter (DN OM) and crude protein (DN CP) of fistulae Ongole breed cows (%)

Parameter	Average		
	P1	P2	P3
DN OM	61.33	62.06	63.06
DN CP	10.69	10.34	10.82

DN OM reflected consumed organic matter digestibility, thus DN value was affected by digestibility level. Average dry matter digestibility of P3 was 64%, but DN value was 63.06%. It indicated that feed material was not fully digested and absorbed by cattle, and there was a small undigestible portion. Utilized feed nutrient for cattle was indicated by Digestible Nutrient (DN) value.

The DN CP value difference between P1, P2 and P3 in this study (Table 3) was caused by protein content difference, of which P3 had highest content of 11.88 % compare to P1 and P2 with similar protein content of 11.57 %. Feed material quality determined digestible nutrient, particularly crude protein. DN CP was related to crude protein digestibility, however DN level was not determined by high digestibility. DN CP indicated digestibility percentage of crude protein consumed by cattle.

Despite slight difference among results, there was no statistically significant difference among 3 treatments using protected palm oil, Indian sardine oil and palm kernel cake, thus treatments was not affecting DN OM and DN CP. The results indicated that there was no any presence of substance which could inhibit digestion process, when the material used in limited amount. Jenskin (1993) cit Agustin (2007) explained that maximum amount of Indian sardine oil utilized in ruminant feed was 6 – 7% of deed dry weight since high level of fat would affect microorganism fermentation in rumen.

4. Conclusion

From the results, it was concluded that utilization of both 5% protected Indian sardine oil and palm oil as well as 10% protected palm kernel cake did not interfere digestion process of fistulae Ongole breed cows, particularly in rumen, and comparable result among dry matter, organic matter, and protein digestibility was obtained.

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